Learning Objectives

- Peripheral Nerve blocks:
  - Benefits: analgesia, quicker discharge, less opiate issues
  - Common issues: brachial plexus block - phrenic nerve involvement
  - Complications: common and rare
  - Management of phrenic nerve blockade

- Epidural analgesia:
  - Benefits: pulmonary, gastrointestinal, analgesia, shorter hospital stay
  - Complications/Risks - infection, bleeding
  - Anticoagulation management
  - Management of epidural hematoma

- Local Anesthetic Systemic Toxicity (LAST):
  - Recognizing the progression - twitching to seizure to CV changes/collapse
  - Intralipid/Fat emulsion - dosing and mechanism of action

Overview

- Case 1 - Hypoxemia after shoulder surgery
- Case 2 - Significant leg weakness after open whipple
- Case 3 - Seizures after total knee replacement
Case 1

A 66M with BMI 36, OSA on CPAP, HTN and hyperlipidemia is on the floor s/p Right TSA. His SpO2 is 88% on 4L NC and he endorses dyspnea. Pre-op he was 96% on room air. The patient had general endo-tracheal anesthesia and an interscalene nerve block for his post-op pain control. What is the MOST likely cause of the hypoxemia?

- A) Pneumothorax
- B) Post-op atelectasis
- C) Opiate pain medication
- D) Phrenic nerve blockade

Regional Anesthesia - WHY?

- Improved post-op pain control
- Reduced opiate need/side effects
- Reduced post-op nausea and vomiting
- Earlier rehabilitation
- Earlier discharge (for some)
- Less stress reaction

Regional Anesthesia

- **Brachial Plexus**
  - Technique: Ultrasound, neuro-stim or paresthesia
  - Large volumes of local anesthetic are placed around nerves
    - 30mL of 0.5% bupivacaine is typical
  - Duration is dependent on Local anesthetic agent, dose and skill
    - 18-24hrs of analgesia is typical
  - Very safe and reliable procedures, if practitioner is experienced.

Brachial Plexus Complications

- **The usual suspects** (potential issues with ALL blocks)
  - Infection, bleeding, nerve damage, local anesthetic toxicity
- **The unusual suspects**
  - Pneumothorax, hemothorax, Horner syndrome, intrathecal injection, recurrent laryngeal nerve block (hoarseness)
- **The forgotten one…**
  - Phrenic nerve blockade

<table>
<thead>
<tr>
<th>Blockade</th>
<th>Best for shoulder</th>
<th>Good for shoulder</th>
<th>OK for shoulder</th>
</tr>
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<tbody>
<tr>
<td>Interscalene</td>
<td>100%</td>
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</tr>
<tr>
<td>Supravascular</td>
<td>50%</td>
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<tr>
<td>Infraclavicular</td>
<td>0%</td>
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Brachial plexus blocks

- **Hypoxemia after Block:**
  - **Pneumothorax**: low risk with U/S Technique and skill (MY = 0%)
    - With significant hypoxemia, severe hypotension and tachycardia
  - **Post-op atelectasis**: rarely results in profound hypoxemia
    - Responds nicely to oxygen and incentive spirometry
  - **Opiates**: a definite issue in patients without a block
    - Patients with a good block should require little opiates.
  - **Phrenic nerve blockade**: MOST likely, with shoulder surgery
    - Interscalene or Supravascular best for analgesia
    - Highest risk for phrenic involvement
    - Acute - Patient communicates SOB quickly
    - PVC is reduced 20-40%
Phrenic nerve blockade

- Anesthesiologist should know better! ("Robots" may not)
- Alter technique in severe pulmonary compromise
- Push the envelope in chronic pain/opiate tolerant patients

**Management:**
- Oxygen, incentive spirometry (for contralateral lung)
- Maintain CPAP for OSA patients
- Watchful waiting: Motor returns before sensory
- Unlikely to require intubation
- If fulminating respiratory failure is to present on floor:
  - Unlikely Phrenic nerve: typically an acute (PACU/OR) issue
  - Consider Pneumothorax, aspiration, PE, other causes...

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**Case 2**

A 49M with obstructive jaundice, who is otherwise healthy, is post-op day 1 from open whipple procedure under general endotracheal anesthesia. The patient has a thoracic epidural for post-op pain control, which is working well, he reports 0/10 pain and 1500mL pulls on his s&h and he feels well. PT stops in to walk him and find that his legs are numb and he has a significant motor blockade to his toes. At surgeon's request, patient was given Enoxaparin 40mg daily sQ qd for DVT ppx. Which is MOST likely to be the cause?

- A) Epidural abscess
- B) Epidural hematoma
- C) Transient Neurologic Symptoms of Local Anesthetic
- D) Well-functioning epidural

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**Epidural Analgesia - Why?**

- Superior pain control
- Decreased pulmonary complications
- Quicker return of bowel function
- Decreased opiate side-effects
- Shorter ICU and hospital stay
- Increased patient satisfaction

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Epidural Analgesia

- **Risks/Complications**
  - Infection, bleeding, nerve damage
  - Epidural hematoma
    - Non-compressible, expanding blood
    - May compress spinal cord and result in paralysis
  - Malpositioned Catheter
    - Intrathecal/Subdural (mimics epidural hematoma)
    - Intravascular
      - TEST DOSE DONE??!

Epidural hematoma

- Presents classically with an increasing/descending motor component. Epidural may mask back pain.
- Fever may be present, but it is usually mild
  - Extremely rare, unless...
    - Traumatic placement
    - Coagulopathy (genetic, pharmacologic, transfusion related)
    - You or the patient have rotten luck

Epidural hematoma

- **Differential Diagnosis/Management**
  - Turn off epidural... It is clouding your exam. Don't remove.
  - Intra-thecal catheter
  - Increasing descending and ascending motor component
  - Aspirate catheter - CSF? Check rapid glucose if clear liquid returns
  - Epidural abscess
    - Should have high fever, >48hrs after epidural placement
  - Septic leak
  - Epidural hematoma
    - Immediate CT or MRI
    - Neurosurgery consult... This may progress to surgical intervention
  - Medication error (high potency local anesthetic substituted)
    - Check the medication that is running in the epidural!
Anticoagulation/VTE Prophylaxis

- **The Quick and Dirty.**
  - ASA is ok.
  - Clopidogrel, warfarin, dabigatran etc, are NOT.
  - **Prophylaxis**: Heparin 5000 units BID/TID subQ is best.
  - **Treatment dose**: Heparin drip is best.
  - Place catheters when PTT returns to normal
  - Remove catheters when PTT returns to normal
  - LMWH: generally avoid with epidural catheter
  - Makes removal and placement more difficult
  - Surgeons should know better…
  - Many are fans of epidurals for the listed reasons and won’t fight

Epidural/Anticoagulation

- Even a Regionalist’s least favorite topic...
- This is an hour topic at LEAST.
- Open-source guides that are great:
  - Stanford University
  - Univ of Washington Medical Center

Case 3

- You are covering the orthopedic unit (someone has to, right?)
  - A rapid response is called for a patient with a seizure. The nurse states the patient is a healthy 54F, ex-marathon runner, with BMI 19, who is post-op day zero from B/L TKA. No prior history of seizure. She has orders for NS 100mL/hr IV, IV hydromorphone PCA and has B/L femoral nerve catheter for pain. What is the MOST likely cause of her seizure?

  - A) Alcohol withdrawal
  - B) Local anesthetic toxicity
  - C) Benzodiazepine withdrawal
  - D) new-onset epilepsy
Local Anesthetic Toxicity

- That story was based on a real patient.
  - Order: IVF NS 100mL/hr, Ropivacaine 0.1% 8mL/hr via fem cath
  - Actual: Ropivacaine 0.1% 100mL/hr IV, NS 8mL via fem cath

- Typically ordered doses are too low to trigger LAST through peripheral nerve catheters.
  - Higher doses are run on chronic pain patients
  - ALWAYS DOUBLE CHECK MEDS/ORDERS BEFORE GIVING!!!

Local Anesthetic Toxicity, cont.

- Progression:
  - Altered sensorium: Tinnitus, perioral numbness
  - Twitching, blinking, “I feel weird.”
  - Seizure
  - Cardiovascular instability
    - ectopy, PVC, VT/VF, hypotension
  - Cardiovascular collapse
    - refractory to typical ACLS

- One does not have to progress through all stages
  - May never develop seizure
  - May go straight to cardiovascular collapse

Local Anesthetic Toxicity, cont.

- Management
  - Altered sensorium:
    - IVF, oxygen
    - IV Benzo not a bad idea if you fear progression (midazolam)
  - Seizure
    - IV Benzo, IVF, Oxygen
    - Airway management (not necessarily intubation)
  - Cardiovascular changes Ectopy, PVCs, VT, VF, hypotension
    - IV intra-lipid via eschar for 20s/1.5mL/kg bolus, infusion follows
    - Manage Airway (not necessarily intubation)
  - Cardiovascular collapse
    - ACLS - CPR/chest compressions! Must circulate intra-lipid
    - Manage airway (intubate!)
    - Low dose amp only (1mcg/kg), NO VASOPRESSIN
    - Both increase afterload, impeding CPR/intra-lipid circulation
Intralipid

- 20% fat emulsion (same as with TPN)
- Works by scavenging active local anesthetic, which is highly lipid soluble
- Bolus 1.25mL/kg to start
- Start infusion 0.25mL/kg/min
- May repeat bolus

Remember... Hoof beats

- LAST is a zebra in the Internist’s world
- I’ve rarely seen even the early stages of it and I am involved in 15-20 blocks per day.
- If your patient has a seizure and there isn’t an obvious reason why the local anesthetic caused it, keep looking.

Finally...

- If your patient has a block or catheter and you are uncomfortable with it, or have an issue...
- Call the person who placed it!
- Continuous catheters should always be managed by the group that placed them.
- They can answer questions about:
  - Anticoagulation/placement/removal
  - “weird” side effects
Thank You!

- Morgan & Mikhail’s Clinical Anesthesiology 4th Edition
- Barash Clinical Anesthesia, 7th Edition

Summit, Coronet Peak; Southern Alps; Queenstown, NZ; July, 2014